

Subject-Specific Competencies for Beginning Teachers in Missouri: Middle School Science

Abbreviations used in this document for coding:

- A. **1997 SSC: 2.1** = 1997 Subject Specific Competencies for Beginning Teachers in Missouri Strand 2, Matter and Energy, competency 1, Properties of matter
- B. **CR GenEd, III.D** = Missouri Elementary General Education “Natural Science” and “Subject(s) Certification” Requirements
- C. **NSTA [2001]: Standard 2.a** = 2001 National Science Teachers Association standards (i.e., those found on the NCATE website: www.ncate.org)
- D. **NSTA [1998]** = 1998 National Science Teachers Association standards conveying more detail than do the 2001 standards; suggested by NCATE as a useful cross-reference to the more recent standards
- E. **National Science Education Standards (NSES):**
 - Unifying Concepts and Processes (UCP)
 - Content Standard A (A): Science as Inquiry
 - Content Standard B (B): Physical Science
 - Content Standard C (C): Life Science
 - Content Standard D (D): Earth and Space Science
 - Content Standard E (E): Science and Technology
 - Content Standard F (F): Science in Personal and Social Perspectives
 - Content Standard G (G): History and Nature of Science
 - Grades K-4: **E**
 - Grades 5-8: **M**
 - Grades 9-12: **H**
- F. **S 1,4** = *Show Me Science* Content Knowledge Standards, standards 1 and 4
- G. **ETS 0439, I** = Educational Testing Service (ETS) Praxis II test “Middle School Science” (test 0439), Topic I (Scientific Methodology, Techniques, and History) (i.e., the information provided in “Tests at a Glance” description of the contents of the middle school science test)

Finally, the following materials are provided in this Middle School Science package:

1. a 2-column table representation of science competencies for the beginning middle school science teacher
2. a “narrative” (or list) of the same information in a conventional word processing format

The beginning (preservice) middle school science teacher will demonstrate knowledge of and/or competency in the following areas of study:

<p>1: Unifying Concepts and Processes The beginning teacher of science is familiar with, and teaches, the major concepts and principles that unify all scientific effort and that are used in each of the science disciplines (1997 SSC: 1.2; CR GenEd, III.D; NSTA [2001]: Standard 1; NSTA [1998], Standard 1; NSES: UCP-1-5)</p>	<p>1.1. systems, order, and organization; 1.2 evidence, models, and explanation; 1.3 change, constancy, and measurement; 1.4 evolution and equilibrium; and 1.5 form and function.</p>
<p>2: Science As Inquiry The beginning teacher of science understands and practices the science inquiry process. (1997 SSC: 1.1, 1.4; CR GenEd, III.D; NSTA [2001]: Standard 3; NSTA [1998], Standard 3; NSES: M-A1, A2; S 7; ETS 0439: I)</p>	<p>2.1 identify questions that can be answered through scientific investigations. 2.2 design and conduct a scientific investigation, including general abilities, such as recognition of the principal elements in an experimental design (i.e., the hypothesis, independent and dependent variables, and controls); systematic observation, making accurate measurements, and identifying and controlling variables; clarifying ideas that are influencing and guiding the inquiry; and comparing ideas with current scientific knowledge 2.3 use appropriate tools (e.g., hand tools, measuring instruments, calculators, and computers for the collection, summary, and display of evidence), techniques, and mathematics to gather, analyze, and interpret data, including selecting the scientific apparatus or instrument appropriate to a specified laboratory or field task and identifying proper operation of such equipment; using the metric system of measurement, recognizing equivalents within that system and selecting units appropriate to a given laboratory or field task; converting between scientific notation and conventional numerals and using scientific notation to perform calculations. 2.4 develop descriptions, explanations, predictions, and models using evidence based on observation and the abilities to differentiate explanation from description, to provide causes for effects, and to establish relationships based on evidence and logical argument and connections between the content of science and the contexts within which new knowledge is developing. 2.5 think critically and logically about relationships between evidence and explanations, including the ability to interpret and express the results of observation and experimentation. 2.6 recognize, construct, and analyze alternative explanations, including the abilities to identify accurate verbal, graphic, and tabular expressions of data derived from observation and experimentation; draw conclusions and make inferences from observations or experimental results presented in verbal, graphic, or tabular form; and describe a scientific relationship in symbolic mathematical terms. 2.7 communicate scientific arguments and explanations.</p>

	2.8 use mathematics in all aspects of scientific inquiry to ask questions; to gather, organize, and present data; and to structure convincing explanations.
3: Physical Science: The beginning teacher of science understands the central concepts, tools of inquiry, and structures of the physical sciences and makes these aspects of subject matter meaningful for students. (1997 SSC: 2.1-2.8, 3.1-3.7; CR GenEd, III.D; NSTA [2001]: Rationale; Standard 1; NSTA [1998], Standard 1; NSES: M-B1, B2, B3; S 1, 2, 7-8; ETS 0439: III)	3.1 Structure of Atoms (ETS 0439: II, III) 3.2 Properties & Changes of Properties in Matter (1997 SSC: 2.1-.8; NSES: M-B1; ETS 0439: III) 3.3 Motion and Forces (1997 SSC 3.1-.7; NSES: M-B2; ETS 0439: III) 3.4 Transfer of Energy (1997 SSC: 2.5-.7; NSES: M-B3; ETS 0439: III) 3.5 General Chemistry and Chemical Reactions in Physical and Life Science (1997 SSC: 2.2-.5; ETS 0439: III) 3.6 Conservation of Energy and Increase in Disorder (1997 SSC: 2.7; ETS 0439: III)
4: Life Science: The beginning teacher of science understands the central concepts, tools of inquiry, and structures of the life sciences and makes these aspects of subject matter meaningful for students. (1997 SSC 4.1-.7, 5.1-.6; CR GenEd, III.D; NSTA [2001]: Rationale; Standard 1; NSTA [1998], Standard 1; NSES: M-C1, C2, C3, C4, C5; S 3, 4, 7-8; ETS 0439: IV)	4.1 Structure and Function in Living Systems (1997 SSC: 4.3-.7; NSES: M-C1; ETS 0439: IV) 4.2 The Cell (1997 SSC: 4.4, NSES: M-C3; ETS 0439: IV) 4.3 Molecular Basis of Heredity (1997 SSC 4.2; ETS 0439: IV) 4.4 Reproduction and Heredity (1997 SSC 4.2-.3; NSES: M-C2; ETS 0439: IV) 4.5 Populations and Ecosystems (1997 SSC 4.1, 5.1-.6; NSES: M-C4; ETS 0439: IV) 4.6 Diversity and Adaptations of Organisms (1997 SSC 5.1-.6; NSES: M-C5; ETS 0439: IV)
5: Earth and Space Science: The beginning teacher of science understands the central concepts, tools of inquiry, and structures of the earth and space sciences and makes these aspects of subject matter meaningful for students. (1997 SSC 6.1-.7, 7.1-.5; CR GenEd, III.D; NSTA [2001]: Rationale; Standard 1; NSTA [1998], Standard 1; NSES: M-D1, D2, D3; S 5-8; ETS 0439: V)	5.1 Properties of Earth Materials (1997 SSC: 6.1-.3, 6.5-.6; ETS 0439: V) 5.2 Structure of the Earth System (1997 SSC: 6.1-.7; NSES: M-D1; ETS 0439: V) 5.3 Earth in the Solar System (1997 SSC: 7.1, 7.2; NSES: M-D3; ETS 0439: V) 5.4 Earth's History (1997 SSC: 6.2; NSES: M-D2; ETS 0439: V) 5.5 Origin and Evolution of the Universe (1997 SSC: 7.3-.5; ETS 0439: V)
6: Science and Technology: The beginning teacher of science understands the relationship between science and technology, can distinguish between natural objects and objects made by humans, and makes these aspects of subject matter meaningful for students by creating experiences in making models of	6.1 compare/contrast scientific inquiry and technological design (NSES: M-E2; ETS 0439: I, VI) 6.2 explain the reciprocal relationship between science and technology (NSES: M-E2; ETS 0439: I, VI) 6.3 explain the intended and unintended consequences of technological designs. (NSES: M-E2; ETS 0439: I, VI) 6.4 identify appropriate problems for technological design (NSES: M-E2; ETS 0439: VI)

<p>useful things and by developing students' abilities to identify and communicate a problem and to design, implement, and evaluate a solution. (1997 SSC: 1.3, 1.4; NSTA [2001], Standards 4, 5.d; NSTA [1998] Standards 2, 4, 5; NSES: M-E1, E2, E3; S 8; ETS 0439: I, VI)</p>	<p>6.5 design a solution or product and use a variety of technologies to model phenomena (NSES: M-E1; ETS 0439: I, VI) 6.6 identify and organize materials and other resources, choose suitable tools and techniques, and work with appropriate measurement methods to ensure adequate accuracy in the implementation of a proposed design. (NSES: M-E1; ETS 0439: I, VI) 6.7 analyze and interpret data obtained from an experiment or investigation, including graphical data, and identify and demonstrate an understanding of sources of error in data that is presented (NSES: M-E1; ETS 0439: I, VI) 6.8 demonstrate understanding of scientific measurement and notation systems (NSES: M-E1; ETS 0439: I, VI) 6.9 collaborate as a team-member in the identification, communication, and resolution of scientific and technological problems. (NSES: M-E2; ETS 0439: I, VI) 6.10 use words, drawings, and simple models to communicate the process and products of technological design and scientific investigation (NSES: M-E1; ETS 0439: I, VI) 6.11 use criteria relevant to the original purpose or need to evaluate completed technological designs or products (NSES: M-E1; ETS 0439: I, VI)</p>
<p>Science in Personal and Social Perspectives: The beginning teacher of science understands the context of science (i.e., relationships among systems of human endeavor including science and technology; relationships among scientific, technological, personal, social and cultural values; and the relevance and importance of science to the personal lives of students) and the social context of science teaching (i.e., the social and community support network within which science teaching and learning occur; relationship of science teaching and learning to the needs and values of the community; and involvement of people and institutions from the community in the teaching of science) and uses this knowledge to enrich the science learning of all students. (1997 SSC: 1.3, 4.3, 4.6, 5.1, 5.4-.6, 6.1; NSTA [2001]: Standards 4, 7; NSTA [1998], Standards 4, 7; NSES: M-F1, F2, F3, F4, F5; S 1, 3-5; ETS 0439: VI)</p>	<p>7.1 Personal Health (1997 SSC: 4.3, 4.6; NSES: M-F1; ETS 0439: VI) 7.2 Populations, Resources, and Environments (1997 SSC: 5.1, 5.4-.6; NSES: M-F2; ETS 0439: VI) 7.3 Types of Resources (1997 SSC: 6.1; NSES: M-F2; ETS 0439: VI) 7.4 Changes in Environments (1997 SSC: 5.1, 5.6; NSES: M-F2; ETS 0439: VI) 7.5 Natural Hazards (1997 SSC: 1.3; NSES: M-F3; ETS 0439: VI) 7.6 Risks and Benefits (1997 SSC: 1.3; NSES: M-F4; ETS 0439: VI) 7.7 Science and Technology in Society (1997 SSC: 1.3; NSES: M-F5; ETS 0439: VI)</p>
<p>8: History and Nature of Science: The beginning teacher of science understands the history and nature of science as a</p>	<p>8.1 Science as a Human Endeavor (1997 SSC: 1.2, 1.5, 1.6; NSES: M-G1; ETS 0439: I) 8.2 Nature of Science</p>

<p>human endeavor and uses this knowledge to make subject matter meaningful for students.</p> <p>(1997 SSC: 1.3, 4.3, 4.6, 5.1, 5.4-6, 6.1; NSTA [2001]: Standard 2.a & 2.b, 4; Standard 7; NSTA [1998], Standard 2.d, 4.b; NSES: E-G1, G2, G3; S 1-8; ETS 0439: I)</p>	<p>(1997 SSC: 1.2, 1.5, 1.6; NSES: M-G2; ETS 0439: I)</p> <p>8.3 History of Science</p> <p>(1997 SSC: 1.2, 1.5, 1.6; NSES: M-G3; ETS 0439: I)</p>
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